ELEVATOR APPARATUS
PANEL SELECTOR
REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers panel district, office, incoming, and final selector elevator apparatus (11-type and D-85387, D-156946, D-156948, D-157331, D-157332, D-159837, and D-159838 brushes, 2- and 9-type brush rods, 1-type trip rods, 3- and 4-type bearings, 8-type indicators, and 1-type guides).

1.02 This section is reissued to incorporate material from the addendum in its proper location. In this process marginal arrows have been omitted.

1.03 Reference shall be made to Section 020-010-711 covering General Requirements and Definitions for additional information necessary for the proper application of the requirements listed herein.

Caution: Whenever adjustments are made on tripped multiple brushes, care shall be exercised to avoid crossing or grounding the brush spring on the terminal. If possible, set the brush on a spare or permanently made busy terminal while adjustments are being made. Then recheck the adjustments on the reference terminal.

1.04 One dip of KS-8496 lubricating compound No. 3 for the purpose of this section is the amount of lubricant retained on a KS-14164 brush after being dipped into the lubricant to a depth of approximately 3/8 inch and then scraped on the edge of the container to remove the surplus lubricant. There should not be sufficient lubricant adhering to the brush to form a drop on the end of the bristles.

1.05 Brush spring tension is that which it is necessary to overcome to start a tripped brush spring away from its associated bank terminal when the gauge is applied at a point on the spring approximately 1/4 inch from the end of the spring.

1.06 Reference Terminal Alignment: A visual inspection shall be made before checking or readjusting any brush to insure that the reference terminal and the associated tip and ring terminals of the same circuit group of terminals by which the brush is to be set are correctly aligned horizontally and vertically with respect to the other terminals in the bank.

1.07 Make-busy Information: Before making any of the inspections or readjustments covered in this section, make the associated selector circuit busy in the approved manner.

2. REQUIREMENTS

2.01 Lubrication

(a) Before the installer starts the operation test, one dip of KS-8496 lubricating compound No. 3 shall be applied to each of the following points:

(1) Fig. 1(A) - The surfaces of the rotating lever and trip armature extension where they come in contact with each other.

(2) The underside of the brush reset lever for a distance of approximately 1/2 inch from the end.

(3) Fig. 1(B) - The surface on the reset bearing plate with which the brush reset lever comes in contact.

Caution: Take care that none of the lubricant gets on the racks or the cork rolls of the drive.

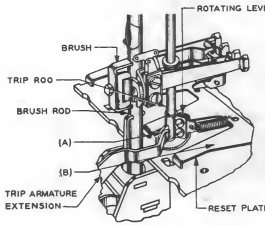

Fig. 1 - Brush and Associated Parts

(b) Recommended Lubrication Intervals: After turnover, rotating levers and trip armature extensions, reset levers and reset or bearing plates which show signs of wear, and reset levers which stick when resetting, together with their associated reset or bearing plates, shall be lubricated at the discretion of the telephone company.

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2.02 Rack Tongue Position: Fig. 2(A)

(a) The rack tongue shall have sufficient tension to hold it against the rack coupling pin.

Gauge by feel.

(b) With the weight of the brush rod assembly resting on the rack or rack bearing washer, the rack tongue shall not touch any of the four sides of the slot in the brush rod.

Gauge by eye.

2.03 Rack Coupling Pin Engagement: Fig. 2(B) - The rack coupling pin shall be sufficiently free in the brush rod to allow the brush rod or the brush rod reinforcing sleeve to rest on the rack bearing washer or the shoulder of the rack and to prevent any twisting motion of the rack within the limits permitted by requirement 2.02 from being transmitted to the rod.

Gauge by eye.

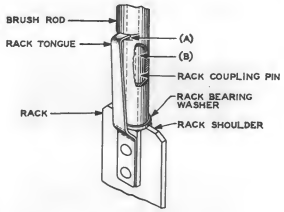

Fig. 2 - Brush Rod and Rack Parts

2.04 1-type Guide Location

(a) Fig. 3(A) - Throughout the length of travel of the brush rod, the prongs of the 1-type guide may touch the front or the rear of the trip rod, but shall not bind at these points.

Gauge by eye.

(b) Fig. 3(B) - The closed side of the 1-type guide shall not touch the trip rod with any brush tripped throughout the length of travel, but the trip rod shall be wholly within the prongs of the guide.

Gauge by eye.

(c) With the upstop collar located in accordance with requirement 2.29 and with all other brush rods in the normal (down)

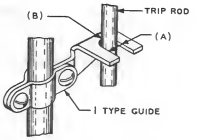

Fig. 3 - 1-type Guide

position, the 1-type guide shall not touch the bearing parts when the associated brush rod is raised to its topmost position.

Gauge by eye.

2.05 Freedom of Movement of Brush Rod: Fig. 4(A) - A brush rod shall be sufficiently free in its bearings to return to the normal (down) position because of its own weight plus the weight of the rack when lowered slowly from any position except the brush restoring position, with the clutch pawl lifted and with any brush tripped.

Gauge by eye and by feel.

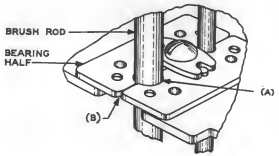

Fig. 4 - 3-type Bearing

To check this requirement proceed as follows. With the brush rod normal, insert the KS-6390 orange stick in back of the left side of the clutch pawl and draw the pawl forward so as to free the rack. Turn the orange stick so the flat surface is next to the clutch frame and push the orange stick downward so as to wedge it in back of the clutch pawl as shown in Fig. 5. Raise the brush rod to its highest position, that is, with an upstop collar touching the underside of its associated bearing locating plate and trip one brush. Exercise care when raising a brush rod which has a tendency to bind. Do not force the rod upward, but first check to see that the bind is not caused by a brush being tripped below its normal tripping position. Failure to observe this warning may result in either bending the trip finger

out of alignment or damaging the rollers on the trip lever assembly. It may also result in injury to the brush rod. Place a finger under the frame of the lowest brush below the mounting screw so as to support the brush rod in its descent. Lower the brush rod slowly and evenly. See that the brush rod follows the movement of the finger without sticking or binding during its entire travel; that is, until the reset lever of a tripped brush touches the associated reset or bearing plate. It is not necessary that the tripped brush be reset by the combined weight of the rod and rack alone [see requirement 2.28(b)].

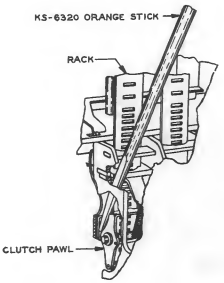

Fig. 5 - Method of Blocking Clutch Pawl

2.06 Brush Rod Bearing Gap: Fig. 4(B) - The bearing halves shall be placed as closely together as possible without causing the brush rod to bind, and the gap, if any, between the bearing halves at both front and rear of the bearing shall be

Max 0.005 inch

Gauge by eye.

2.07 Brush Stud Gap

(a) Fig. 6(A): With the brush tripped and centered on the reference terminal of the bank, the stud gap shall be

Test - Min 0.005 inch
Readjust - Min 0.008 inch

Use the No. 86 gauge.

The stud shall not touch the adjacent sleeve spring at any other terminal of the bank.

Gauge by eye.

(b) Clearance Between Springs (Applies Only to Brushes Equipped With Flexibly Mounted Tip and Ring Contact Shoes): With the brush in the normal (untripped) position, there shall be a clearance between either sleeve spring and the adjacent tip and ring springs of

Min 1/64 inch (the thickness of the brush spring)

Gauge by eye.

A slip of white paper inserted between the flexible shoe mountings and the brush frame will facilitate observing this spring clearance, particularly on the tip side of the brush.

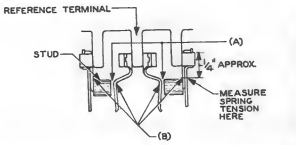

Fig. 6 - Brush Tripped on Reference Terminal

2.08 Brush Instrusion: Fig. 7(A) - When the brush is tripped on any terminal in the bank, the contacting surfaces of the springs shall project in from the end of the terminal not less than half and not more than the full width of the shoe. This requirement may be checked at the top, bottom, and middle of the bank. It will be satisfactory if this requirement is slightly exceeded at the top or bottom of the bank in isolated cases, provided these cases are not due to any general misalignment of the bank.

Gauge by eye.

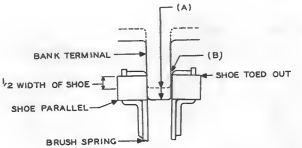

Fig. 7 - Parallelism of Contacting Surface of Brush Springs and Brush Intrusion

2.09 Horizontal Centering of Brushes: Fig. 8(A) - With the brush in the reset position at the reference terminal of the bank, the clearance between the sleeve spring shoes and the tip and ring terminals shall be

Min 0.010 inch

Gauge by eye.

If one shoe touches its adjacent terminal, this requirement is met if the clearance can be obtained in the following manner. Move the springs of the brush to the left or right until the back of the other shoe touches its adjacent terminal. Then release the pressure slowly, allow the brush to assume its normal position, and check the clearance.

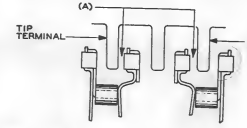

Fig. 8 - Brush in Reset Position at Reference Terminal

2.10 Tip and Ring Spring Clearance: Fig. 9(A) - With the brush in its reset position and with the rack resting on the pawl for any position of the bank, and with the brush held so that the back of the sleeve spring further from the tip or ring spring being tested is touching its adjacent tip or ring terminal, the clearance between either the tip or ring spring and its associated terminal shall be

Min 1/64 inch

Use the No. 89 gauge.

To check this requirement, raise the brush rod until the brush is in line with the reference terminal and check clearance. To insure a 1/64-inch clearance on any other terminal in the bank, make allowance for any lateral offset of the bank terminals.

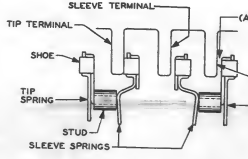

Fig. 9 - Tip and Ring Spring Clearance

2.11 Parallelism of Contacting Surface of Tip, Ring, and Sleeve Brush Springs: Fig. 7(B) - When the brush is contacting with the reference terminal, the deviation from parallel between the contacting surface of the tip, ring, or sleeve spring and the contacting surface of the terminal shall be as small as possible. In any case, when the brush intrusion equals the full width of the shoe, the shoe shall not toe out more than 0.005 inch and it shall not toe in. If the brush intrusion is less than the full width of the shoe, the amount that the spring and terminal may be out of parallel is proportional to the amount of brush intrusion, being 0.0025 inch when the brush intrusion equals one half the width of the shoe.

Gauge by eye.

To check this requirement, use No. 510C test lamp as shown in Fig. 10.

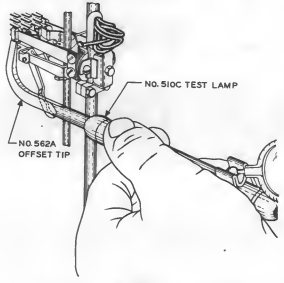

Fig. 10 - Method of Checking Parallelism

2.12 Brush Spring Tension: Fig. 6(B) - With the brush tripped and centered on the reference terminal of the bank, the tension of each spring shall be

(a) For all springs except tip and ring springs of brushes equipped with rigidly mounted tip and ring contact shoes associated with banks treated with petrolatum compound and for all springs of brushes equipped with flexibly mounted contact shoes

Test	-	Min 25 grams
	-	Max 50 grams
Readjust	-	Min 30 grams
	-	Max 45 grams

Use the No. 68D gauge.

(b) For tip and ring springs only of brushes equipped with rigidly mounted contact shoes associated with banks treated with petrolatum compound

Test	- Min 40 grams
	- Max 65 grams
Readjust	- Min 45 grams
	- Max 60 grams

Use the No. 68D gauge.

To check this requirement, apply the tip of the No. 68D gauge at the crimp just back of the brush contact shoe (as shown in Fig. 11) on brushes equipped with flexibly mounted tip and ring springs. On all other brushes, apply the gauge at a point approximately 1/4 inch from the end of the spring. Make the two adjacent circuits busy in order to avoid interference during the gauging operation.

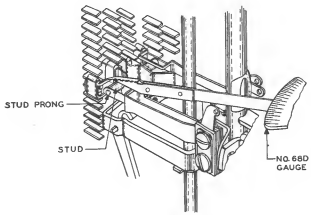

Fig. 11 - Method of Measuring Tension of Brush Springs

2.13 Bridging Sleeve Spring Location

(a) Lower Spring: With the brush rod raised so that the rack index number 49 shows just above the clutch sighting plate and with the weight of the brush rod assembly resting on the clutch pawl, the upward travel of the lower sleeve spring from the rest position to the point of break with the reference terminal shall be

0.075 inch ±0.005 inch

Use the No. 396A rack locater.

(b) Higher Spring: Fig. 12(A) - With the rack index number 52 showing just above the clutch sighting plate and with the weight of the brush rod assembly resting on the clutch pawl, the top edge C of the higher sleeve spring shall not be above the center line of terminal 53.

Gauge by eye.

Note: It shall be considered satisfactory if there is no stagger between sleeve springs.

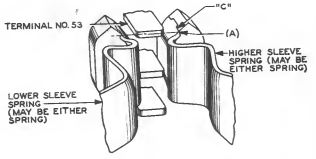

Fig. 12 - Bridging Sleeve Spring Location

2.14 Nonbridging Sleeve Spring Location

(a) Nos. 11B and 11E Brushes: Fig. 13(A) - With the weight of the brush rod assembly resting on the clutch pawl, the center line of the contact portion of the sleeve spring shall coincide with the center line of bank terminals 2, 49 (reference terminal), and 97 with the following tolerances:

Terminal	Rack Notch Number	Tolerances Test	Readjust
2	2	±0.015 in.	±0.015 in.
49	49	±0.010 in.	#coincides
97	97	±0.015 in.	±0.015 in.

Gauge by eye. (The bank terminals are 0.020 inch thick.)

In cases where it is not possible to meet the readjust requirement both on the reference terminal and on terminals 2 and 97, it will be permissible to vary the adjustment on the reference terminal by not more than ±0.010 inch.

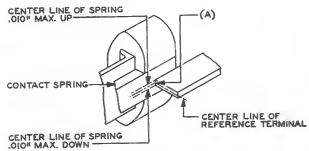

Fig. 13 - Nonbridging Sleeve Spring Location - Nos. 11B and 11E Brushes

(b) Nos. 11C, 11F, 11G, and 11M, and D-85387, D-156948, D-157332, and D-159838 Brushes: Fig. 14(A) - The requirements specified in (a) shall apply to each of the two sleeve springs of these brushes.

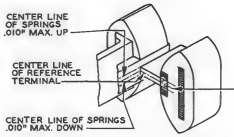

Fig. 14 - Nonbridging Sleeve Spring Location - Nos. 11C, 11F, 11G, and 11M, and D-85387, D-156948, D-157332, and D-159838 Brushes

2.15 Tip and Ring Spring Location: Fig. 15(A)

(a) Test: The upper edge of the contact portion of the spring shall not be below the upper edge of the terminal and the lower edge of the contact portion of the spring shall not be above the lower edge of the terminal when the weight of the brush rod assembly is resting on the clutch pawl for any position on the bank.

Gauge by eye.

(b) Readjust: With the pawl engaging the notch in the rack corresponding to the reference terminal and with the weight of the brush rod resting on the clutch pawl, the upper edge of the contact portion of the brush spring shall be min 0.015 inch (3/4 thickness of terminal) above the top edge of the reference terminal and the lower edge of the contact portion of the brush spring shall be min 0.015 inch below the bottom edge of the reference terminal.

Gauge by eye.

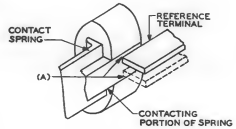

Fig. 15 - Tip and Ring Spring Location

2.16 Point of Contact Between Trip Armature Extension and Rotating Lever: With the trip armature in its normal position, the point of contact between the rounded surface of the tip of the trip armature extension and the rotating lever shall be:

(a) Later-type (Two Piece) Rotating Lever: Fig. 16(A)

Test - Inside the corner at the front edge of the rotating lever.

Readjust - Min 1/32 inch from the corner at the front edge of the rotating lever.

Gauge by eye.

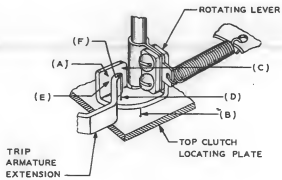

Fig. 16 - Later-type Rotating Lever

(b) Earlier-type (One Piece) Rotating Lever: Fig. 17(A) - Inside the rounded corner at the front edge of the rotating lever.

Gauge by eye.

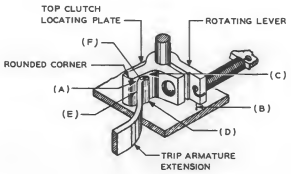

Fig. 17 - Earlier-type Rotating Lever

2.17 Clearance Between Rotating Lever and Top Clutch Locating Plate: Figs. 16(B) and 17(B) - This clearance shall be

Min 0.020 inch

Use the No. 91B gauge.

2.18 Vertical Location of Trip Armature Extension With Respect to Rotating Lever: The tip of the trip armature extension shall not

(a) Figs. 16(C) and 17(C) - Project above the contacting surface of the rotating lever.

Gauge by eye.

(b) Fig. 16(D) - Come in contact with the top surface of the horizontal section of the 2-piece rotating lever directly below it in any position of rotation of the rotating lever.

Gauge by eye.

(c) Fig. 17(D) - Project below the contacting surface of the one-piece rotating lever.

Gauge by eye.

2.19 Parallelism of Contact Between Trip Armature Extension and Rotating Lever: Figs. 16(E) and 17(E) - With the trip armature in its normal position, the deviation from parallel between the trip armature extension and the rotating lever surfaces where they come in contact with each other shall be

Max 0.005 inch

for the full width of the trip armature extension.

Gauge by eye.

2.20 Location of Sharp Edge of Trip Armature Extension: Figs. 16(F) and 17(F) - With the trip armature in its fully operated position, the sharp edge at the end of the rounded portion of the trip armature extension shall not come into contact with the rotating lever.

Gauge by eye.

2.21 Clearance Between Trip Armature Extension and Rack: Fig. 18(A) - With the trip armature fully operated, the clearance between the trip armature extension and the rack for all positions of the rack shall be

Min 0.015 inch

Use the No. 92E gauge.

2.22 Clearance Between Trip Armature Extension and Adjacent Brush

(a) Fig. 18(B) - With the trip armature in the normal position, the trip armature extension shall not touch the reset lever of the brush to the right of it.

Gauge by eye.

(b) With the trip magnet fully operated, the trip armature extension shall not touch the frame of the brush directly above it.

Gauge by eye.

2.23 Clearance Between End of Trip Finger and Sleeve Springs: Fig. 19(A) - When a brush in the normal (reset) position passes a trip finger in either the operated or non-operated positions, the clearance between the end of the trip finger and the sleeve spring shall be

Min 1/16 inch

Use the No. 89 gauge.

2.24 Horizontal Clearance Between Trip Finger and Trip Lever: Fig. 19(B) - When a brush in the normal (reset) position passes a trip finger in either the operated or the nonoperated position, the horizontal clearance between the trip finger and the trip lever shall be

Min 1/64 inch

Use the No. 89 gauge.

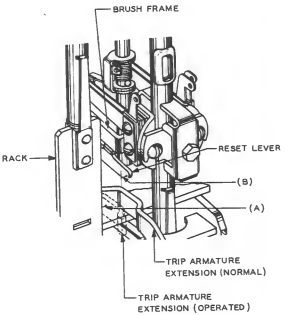

Fig. 18 - Trip Armature Extension and Adjacent Parts

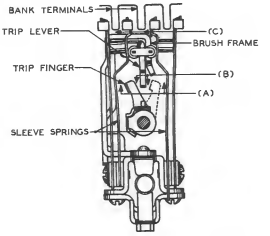

Fig. 19 - Trip Finger Clearance

2.25 Trip Finger Return to Normal: Fig. 20(A) - Trip fingers shall not be sluggish when allowed to return very slowly from the trip position to the normal position.

Gauge by eye and by feel.

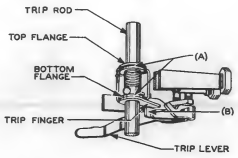

Fig. 20 - Brush and Trip Finger Clearance

2.26 Freedom of Movement of Trip Rod: There shall be no tendency for the trip rod to fail to operate or be sluggish in operation or in returning to its normal position when the trip magnet armature is slowly operated manually and slowly released.

Gauge by eye and by feel.

To check this requirement, operate the trip magnet manually by grasping the trip magnet armature and the core farther from the fulcrum between the thumb and forefinger, squeezing them together and then allowing the armature to release slowly under pressure.

2.27 Vertical Clearance Between Bottom of Horizontal Flange of Trip Finger and Trip Lever: Fig. 20(B) - With the trip finger engaging the trip lever and with the trip rod down against the top channel of the friction roll drive, this clearance shall be

Min 1/64 inch
Max 1/16 inch

Use the No. 89 gauge.

2.28 Downstop Collar Location

(a) Location of Downstop Collars With Respect to Bearings: The downstop collars shall rest upon the brush rod bearings when the brush rod is in the normal or lowest position.

(1) In the case of earlier-type collars, Fig. 21(A), only one collar need rest on the brush rod bearing in the normal position, but the clearance, if any, between the other collar and the bearing shall be

Max 0.005 inch

Gauge by eye.

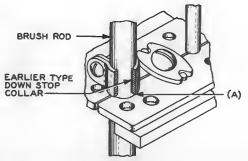

Fig. 21 - Earlier-type Downstop Collar

(b) Brush Reset: Fig. 22(A) - When the brush rod is lowered under power, any tripped brush shall reset with a snap with a

Test - 0.010 inch (No. 85B gauge)
Readjust - 0.020 inch (No. 85C gauge)

placed below the nearest downstop collar.

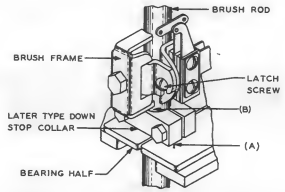

Fig. 22 - Later-type Downstop Collar

(c) Downstop Collar and Brush Frame Clearance: This clearance shall be

(1) For later-type collars, Fig. 22(B)

Test - Min 1/64 inch (No. 89 gauge)
Readjust - Min 1/16 inch (No. 89 gauge)
- Max 0.120 inch (No. 84B gauge)

(2) For earlier-type collars

Test - Min 0.005 inch (No. 86 gauge)
Readjust - Min 1/64 inch (No. 89 gauge)
- Max 0.047 inch (No. 109A gauge)

(d) Y Commutator Brush Spring Clearance: Fig. 23(A) - With the brush rod in its normal (down) position, there shall be a clearance between the lower edge of the contact portion of each Y commutator brush spring and the top edge of the reference hole in the corresponding Y segment of

Min 0.020 inch

Gauge by eye. (The Y spring is 0.016 inch thick.)

(l) At the time of turnover this clearance shall be checked with all brush rods in the normal (down) position.

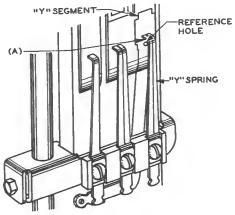

Fig. 23 - Commutator Brush

(e) Clearance Between Each Brush Frame and Cross Member: Fig. 24(A) - With the brush rod in its normal (down) position this clearance shall be

Test - Min 0.005 inch
Readjust - Min 0.015 inch

Use the Nos. 85A and 85F gauges.

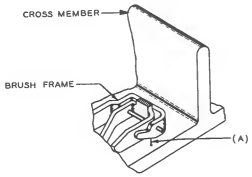

Fig. 24 - Clearance Between Brush Frame and Cross Member

2.29 Clearance Between Brush Rod Upstop Collar and Bottom of Bearing Plate: Fig. 25(A) - With the weight of the brush rod assembly resting on the clutch pawl and with the rack index number 101 showing just above the clutch sighting plate, this clearance shall be

Min 0.030 inch
Max 1/16 inch

Use the Nos. 89 and 92J gauges.

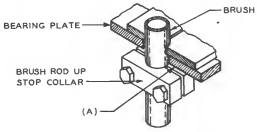

Fig. 25 - Brush Rod Upstop Collar Position

2.30 Clearance Between Trip Rod Upstop Collar and Bottom of Bearing Plate: Fig. 26(A) - This clearance shall be

Min 0.010 inch
Max 0.020 inch

Use the Nos. 85B and 85C gauges.

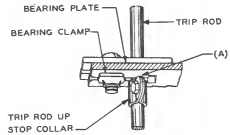

Fig. 26 - Trip Rod Upstop Collar Position

2.31 Clearance Between Brush Frame and Bank Terminals: Fig. 19(C) - With the rack index numbers 10 and 40, respectively, showing just above the clutch sighting plate and with the rack resting on the clutch pawl, this clearance on No. 0 bank shall be

Min 1/32 inch

On earlier frames only which do not have a bearing plate above the No. 4 bank, this clearance shall also be met at the top terminal of the No. 4 bank when the brush rod is raised so that the rack index number 99 shows just above the clutch sighting plate and the rack rests upon the clutch pawl.

Gauge by eye.

2.32 Smooth Brush Travel: With the brush tripped and as the selector travels up and down in normal operation, each brush shall:

(a) Run smoothly over the bank terminals without chattering.

(b) Not snag against the bank terminals.

(c) Not ride off the bank terminals.

2.33 Location of No. 8A Indicator on Final Frames: With the rack index number 49 showing just above the clutch sighting plate and with the rack resting on the clutch pawl, the indicator pointer shall line up within ±1/64 inch of the mark on the indicator strip between Nos. 48 and 50.

Use the R-8550 steel scale.

3. ADJUSTING PROCEDURES

3.001 List of Tools, Gauges, Materials, and Test Apparatus

Code or Spec No.	Description
Tools	
50B	Spring Adjuster
206	30-degree Offset Screwdriver
207	90-degree Offset Screwdriver
240	Scriber
325B	Adjuster
326B	Adjuster
328	Guide Adjuster
329	Guide Holder
331	Spring Adjuster
376A	Dental Mirror
380A	Spring Adjuster
396A	Rack Locater
489A	Stud Adjusting Pliers
510C	Test Lamp [must be equipped with No. 562A tool (offset tip) and W2BL (48V) cord]
555A	3/16-inch Hex. Single-end Socket Wrench
583A	Spring Adjuster
D-159676	Trip Finger Spring Adjuster
KS-2631	Screwdriver
KS-2632	Reading Glass
KS-6320	Orange Stick
KS-6854	Screwdriver
KS-14164	Brush
KS-14250,L1	Flashlight
R-2830	Spring Adjuster
-	6-1/2-inch P-Long-nose Pliers
-	3-inch Cabinet Screwdriver
-	6-inch Cabinet Screwdriver
Gauges	
68D	70-0-70 Gram Gauge
84B	0.110- and 0.120-inch Double-end Thickness Gauge
85A	0.005-inch Thickness Gauge
85B	0.010-inch Thickness Gauge
85C	0.020-inch Thickness Gauge
85F	0.015-inch Thickness Gauge
86	0.005- and 0.008-inch Double-end Offset Thickness Gauge
89	1/16- and 1/64-inch Round Thickness Gauge
91B	0.020-inch Thickness Gauge
92E	0.015-inch Offset Thickness Gauge
92J	0.030-inch Offset Thickness Gauge
109A	0.049- and 0.047-inch Double-end Thickness Gauge
R-8550	Steel Scale
Materials	
KS-2423	Cloth
KS-7860	Petroleum Spirits
KS-8496	Lubricating Compound No. 3
KS-14666 (or replaced D-98063)	Cloth
KS-14694	Scouring Pad
-	Dixon's No. G712 Graphite Lubricating Stick (The Joseph Dixon Crucible Co., Jersey City, N.J.)
-	No. 00 Emery Cloth
Test Apparatus	
1W13B (three required)	Cord - One equipped with a No. 365 connecting clip at one end, one equipped with a No. 357 spring contact clip at one end, and one equipped with a No. 365 connecting clip at one end and a No. 357 spring contact clip at the other end

3.002 Use of Reading Glass and Dental Mirror: The KS-2632 reading glass and the No. 376A dental mirror may be used in connection with the visual inspections specified in Part 2 Requirements and the corresponding adjusting procedures.

3.003 Location of Tip and Ring Springs: Selector brushes on standard coded banks and the front side of D-specification banks have their tip springs on the left-hand side of the brush assembly. Brushes used on the rear of D-specification banks have their tip springs on the right-hand side and their ring springs on the left-hand side of the brush assembly.

3.004 Shifting Brushes Horizontally: Exercise care, when shifting a brush horizontally, to avoid moving the brush up or down since this may destroy other adjustments. To shift

a brush horizontally, loosen the brush clamping bracket screw with the No. 555A wrench, taking care not to loosen the screw more than necessary. Rotate the brush slightly with respect to the brush rod so that requirements 2.09, 2.10, 2.11, 2.12, 2.23, 2.24, and 2.31 are met. Securely tighten the brush clamping bracket screw.

3.005 Shifting Brushes Up or Down: To shift a brush up or down, loosen the brush clamping bracket screw slightly with the No. 555A wrench. With the wrench on the screw, tap the shank of the wrench up or down as required. Do not tap the frame of the brush in making this adjustment as this may mar the finish or distort some part of the brush assembly. Since the horizontal setting of the brush may be disturbed in shifting the brush up or down, check the requirements listed in 3.004 and in addition check requirements 2.13, 2.14, 2.15, 2.27, and 2.28. Securely tighten the brush clamping bracket screw.

3.006 In checking and readjusting to meet some of the brush requirements specified herein, the brush is tripped on the reference terminal. On incoming selector circuits, where the overflow register is connected to the reference terminal, take particular care when using the No. 68D gauge and the Nos. 331, 380A, and R-2830 adjusters to prevent grounding the brush on the trip rod or on the terminal above or below so as to avoid operating the register.

3.007 To clean brush shoes, proceed as follows. Where a brush appears dirty, clean the brush and guide comb according to approved procedures. Where a brush is equipped with silver contact shoes on the tip and ring springs and this method is ineffective, the trouble may be caused by sulphide film which appears as a dark coating on the contacting surfaces. In such cases, clean the brush shoes as follows. From a KS-14694 scouring pad, cut a strip across the pile, 1/2 inch wide by 2 inches long. Fold the pad over the end of a KS-6320 orange stick with the pile side out and secure the pad to the orange stick by means of a rubber band. Saturate the pad with KS-7860 petroleum spirits. With the brush in the normal (down) position, abrade the contacting surfaces with a few strokes of the pad.

3.01 Lubrication (Rq 2.01)

(1) Lubrication of Rotating Levers and Trip Armature Extensions: Raise the brush rod associated with the rotating lever to be lubricated so that it is in position to trip the lowest brush on the selector.

(2) Operate the trip rod manually so as to open up a space between the rotating lever and the trip armature extension. Apply one dip of KS-8496 lubricating compound No. 3 to the rotating lever and the trip armature extension as shown in Fig. 27.

(3) Take care that the lubricant does not get on the racks or cork rolls of the drive. After applying the lubricant it is advisable, if service conditions permit, to allow the parts lubricated to remain idle for approximately 15 minutes to permit the trichloroethylene in the lubricant to evaporate.

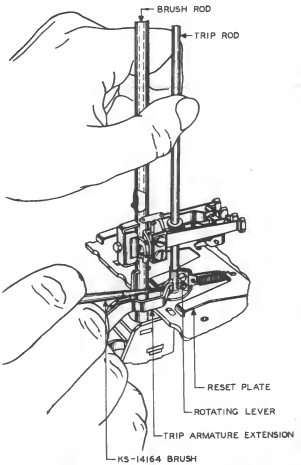

Fig. 27 - Method of Lubricating Rotating Lever and Trip Armature Extension

(4) Lubrication of Reset Levers and Reset or Bearing Plates: If the reset lever, or the reset or bearing plate with which it comes in contact, shows signs of wear or if the reset lever snags against the reset or bearing plate as the brush restores to its normal position, apply one dip of KS-8496 lubricating compound No. 3 to the surface of the reset or bearing plate where the reset lever comes in contact with it and 1/2 inch of the undersurface of the reset lever at the end of the lever where it comes in contact with the reset or bearing plate. After applying the lubricant it is advisable, if service conditions permit, to keep the reset lever from rubbing on the reset plate for 15 minutes to allow the trichloroethylene in the lubricating compound to evaporate.

(5) If necessary, clean the surfaces referred to in (4) with a dry KS-14666 cloth. If it is found that, due to the presence of a gummy or sticky deposit, the surfaces cannot be cleaned with a dry cloth, the cloth may be saturated with KS-7860 petroleum spirits. If it is found necessary

to use petroleum spirits for cleaning purposes, do not apply the lubricant until the petroleum spirits has evaporated.

3.02 Rack Tongue Position (Rq 2.02)

(1) If the rack tongue does not assume its correct position in the brush rod, it is either distorted or the brush rod is twisted. If the rack tongue is distorted, straighten it with a pair of long-nose pliers. If the brush rod is twisted, loosen the brushes and the commutator brush with the No. 555A wrench and turn the rod to its correct position; then relocate the brushes in accordance with the requirements for this apparatus specified herein or in Section 026-120-701.

3,03 Rack Coupling Pin Engagement (Rq 2.03)

(1) If the brush rod appears to bind on the rack coupling pin, that is, if the rod does not return to the shoulder of the rack or the rack bearing washer when raised and released, first make certain that this is not caused by a binding or bowed brush rod (see 3.05 - 3.06). If the brush rod is not binding or bowed, uncouple the rack and examine the coupling pin to see that it is not bent. Also see that there are no short bends in the lower end of the brush rod. Check to see that there are no burrs or dirt in the hole in the brush rod, and that the hole is large enough to permit the rack coupling pin to enter freely.

(2) If the brush rod is worn at the bottom so that it does not twist freely on the rack shoulder, it will be necessary to recondition the brush rod as covered in Section 026-125-804.

3.04 l-type Guide Location (Rq 2.04)

(1) When a guide binds on a trip rod in the ascent or descent of the brush rod, bend the guide with a No. 328 adjuster, placing the No. 329 holder with its slot down over the back end of the guide and over the rod to secure it firmly as shown in Fig. 28.

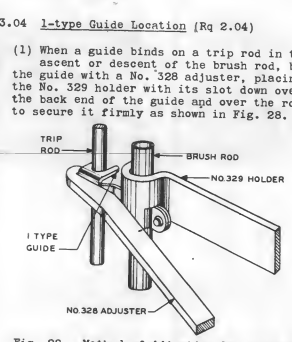

Fig. 28 - Method of Adjusting l-type Guide

(2) Should the trip rod appear bent so as to cause the guide to bind in only one or two points, straighten the trip rod at these points.

(3) If it is found that the guide comes in contact with any of the bearing parts when at the topmost limit of its travel, loosen the clamping screws which hold it to the brush rod with the 6-inch cabinet screwdriver, and lower the guide assembly so that it clears the bearing parts. Tighten the clamping screws, making sure that the requirement is met.

3.05 Freedom of Movement of Brush Rod (Rq 2.05)
3.06 Brush Rod Bearing Gap (Rq 2.06)

(1) Before making any adjustments, check to see that there is no interference caused by the commutator brush local cable form coming in contact with a commutator or the form snagging on an adjacent brush frame. Also, make sure that, when the brush rod is lowered to the normal or lowest position, the top of the rack is above the underside of the rack guide so as to avoid the possibility of the rack snagging on the rack guide. If the latter condition exists, lower the brush rod downstop collar slightly as covered in 3.28, making sure that requirement 2.28 is met.

(2) Binding of the brush rod may be caused by dirt accumulations on the rod or by improper mechanical adjustment. If the bind is due to dirt accumulations, treat the surfaces of the rod with Dixon's No. G712 graphite lubricating stick as follows. Where graphite has not previously been used, clean all accessible portions of the rod above the brushes with a KS-2423 cloth moistened with KS-7860 petroleum spirits, taking care to keep on those portions of the rod at least one inch from the brushes. Raise the brush rod and similarly clean the portions of the rod below the brushes which engage the bearings when the rod is normal. Then apply graphite to the rod as covered in (3). Where graphite has previously been used, subsequent cleaning of the brush rod with the cloth and petroleum spirits will ordinarily not be necessary.

(3) With the brush rod in the normal position, apply Dixon's No. G712 graphite lubricating stick over the front and side surfaces of the rod with a downward motion and moderate pressure. Three such strokes will usually be sufficient. Take care in doing this to keep at least one inch from the brushes and bearings. Repeat this operation for each section of the rod. Then rub the rod lightly with a dry KS-2423 cloth so as to distribute the graphite over all accessible portions of the rod.

(4) When the cloths become dirty, discard them in a suitable container.

(5) If a bind sufficient to prevent the brush rod from meeting this requirement occurs at or near the top of the brush rod travel, the cause may be a misaligned clutch, a binding guide, or both.

(6) To determine the cause, uncouple the rack and raise the brush rod as high as it will go. If the bind has been removed, it may have been caused by a misaligned clutch or a bowed brush rod. If the bind is still present, it may be due to a misaligned guide. If so, readjust as covered in 3.04.

(7) If the clutch is out of alignment, correct as covered in the section covering the type of clutch involved. Also check requirements 2.09, 2.13, 2.14, 2.15, 2.16, 2.19, 2.20, 2.21, and 2.27.

(8) If the brush rod binds only in spots throughout its travel, the binding may be caused by interference between the bearings. Stop the rod on one of the binding spots and check each bearing, in turn, for play in a straight front to rear direction by grasping the rod in the fingers directly below the bearing and moving it backwards and forwards and then from side to side. If the bearing does not show a perceptible play, check that the bearings meet requirement 2.06.

(9) If the requirement is not met, before separating the halves of a bearing, make sure that the bind is not caused by misalignment of the bearing halves. If the bind is due to the displacement of one half of the bearing with respect to the other half, correct by lightly tapping the bearing halves with the screwdriver handle.

(10) Close bearings that are open more than the permissible amount by tapping the bearing half into the correct position with the 3-inch cabinet screwdriver. Always dress the bearing halves to the left and to the rear. Do not pry against the adjacent bearing. A light held just below the bearing locating plate will be found of considerable help in checking for open bearings.

(11) What may seem to be a uniform bind throughout the travel of the brush rod is probably caused by excessive brush spring tension. Check the tensions of all the brush springs, and where they are found to be excessive or close to the maximum requirements, reduce them slightly. Try to apportion the adjustment so as to set each spring approximately at its mean requirements rather than to reduce any one spring to its minimum requirements. Refer to 3.12 and to Section 026-120-701.

(12) Binds caused by kinks and bends in the brush rod will also be noticed as occurring only in certain spots during the travel of the rod. If there is front to rear play in every bearing, and if there is no bind due to heavy brush tension, interference with the 1-type guide or a misaligned clutch, examine the rod carefully to ascertain whether it is straight throughout its entire length. If kinks or bends are located, straighten the rod by grasping it in the fingers above and below the bent portion and bowing the rod in a direction to correct the bend. Be careful to leave the rod straight and not to produce any kinks in it. After straightening the rod, check requirements 2.08, 2.09, 2.13, 2.14, 2.15, and 2.31. If the fault cannot be discovered in any other way, remove one pair of bearings at a time. With a bearing removed, that part of the rod which is bowed will be plainly shown by its position with respect to the bearing supporting plate. After making this check, remount the bearing before removing another bearing.

3.07 Brush Stud Gap (Rq 2.07)

(1) Unless the sleeve springs are distorted, adjust the outside springs as shown in Fig. 29, using the No. 331 adjuster. Use extreme care in making this adjustment not to distort the spring.

(2) Brushes Equipped With Flexibly Mounted Tip and Ring Contact Shoes: Adjust the stud gap with the No. 583A spring adjuster. Apply the adjuster near the base of the stud prong, taking care not to apply pressure against the stud in a direction which would tend to force the stud off the prong. Then reset the brush and check to see that part (b) of the requirement is met.

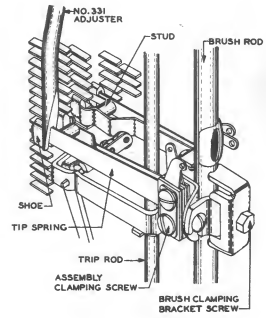

Fig. 29 - Method of Adjusting for Brush Stud Gap

3.08 Brush Intrusion (Rq 2.08)

(1) If failure to meet this requirement is common to several adjacent brushes on one bank, it is an indication that the bank is out of alignment. Where the cases of failure are isolated, make a check to see whether or not the brush rod is bent in or out and if so, straighten the brush rod as covered in 3.05-3.06. If, however, the brush rod is straight and this condition exists, do not bend the brush rod to correct it. It is sometimes possible to correct the above conditions by moving the brush rod bearings. Since the brush itself is not involved in this adjustment, do not readjust it to meet this requirement. If, however, any of the adjustments covered above are made, check requirements 2.09, 2.10, 2.12, 2.13, 2.14, 2.15, and 2.31. It is satisfactory if in isolated cases a brush only approximately meets the requirement at the top or bottom of the bank, provided it meets it at the reference terminal and provided a check is made with other brushes to insure that the failure to meet the requirement is not due to misalignment of the bank.

3.09 Horizontal Centering of Brushes (Rq 2.09)

(1) If there is no clearance between the back of one sleeve shoe and a tip or ring terminal, and a large clearance between the back of the other sleeve shoe and its associated tip or ring terminal, this condition will usually be caused by the whole brush assembly being shifted sideways. To correct this, shift the brush horizontally slightly as covered in 3.004, so that both sleeve springs will be approximately equidistant from the adjacent sleeve terminal.

(2) If it is found impossible to obtain the desired clearance by following (1) and either or both of the sleeve spring shoes still make contact with the tip or ring terminals, it will generally be found that the gap between the sleeve spring at fault and the adjacent tip or ring spring at the first bend of the sleeve spring will be much greater than normal. To correct this condition, apply the No. 380A adjuster to the sleeve spring close to its base and push it toward the contact end of the spring while exerting a slight pressure that will bow the spring outward. It may be necessary to repeat this operation to obtain the perceptible clearance. Recheck requirement 2.07.

3.10 Tip and Ring Spring Clearance (Rq 2.10)

(1) Examine the brush to see if it is in accordance with Fig. 9 for the purpose of determining what condition is responsible for this lack of clearance and the necessary means to be used in correcting it.

(2) If the tip, ring, or sleeve springs are not distorted but the stud gap is larger than required, adjust as covered in requirement 2.07 by adjusting the tip or ring spring with the No. 331 adjuster as shown in Fig. 29. Check requirements 2.09, 2.11, and 2.12.

3.11 Parallelism of Contacting Surface of Tip, Ring, and Sleeve Brush Springs (Rq 2.11)

(1) Adjust the brush springs at a point in front of the studs with the No. 331 adjuster so that the contacting surfaces of the shoes are parallel to the terminals or toe out slightly, but do not toe in (see Fig. 30). Recheck requirements 2.07 and 2.10. It may be necessary in some cases where the shape of the spring has been changed to decrease the effective length of the stud. To do this, press the stud on the stud mounting pin, using the No. 489A stud adjusting pliers. In using this tool, engage the stud with the tip of the pliers and press the stud onto the stud mounting pin as far as permitted by the stop between the jaws of the pliers as shown in Fig. 31. Make sure that the stud mounting pin does not protrude beyond the stud and short-circuit the springs.

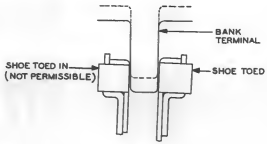

Fig. 30 - Toe-in and Toe-out Condition of Brush Shoes

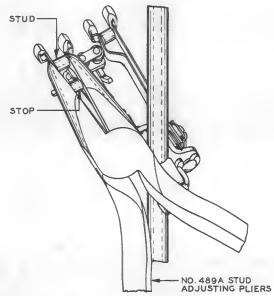

Fig. 31 - Method of Decreasing Effective Length of Stud

(2) Brushes Equipped With Flexibly Mounted Tip and Ring Contact Shoes: With the brush in the reset position, the tip and ring shoes may toe in. No attention need be paid to this condition if the brush meets its requirements. Adjust the parallelism of the tip and ring brush shoes with the No. 583A spring adjuster applied as shown in Fig. 32. Take care to engage both members of the flexible shoe mounting so that they will be adjusted equally and thereby avoid tilting the shoe. After this adjustment has been made, recheck requirement 2.07(b). Adjust for parallelism on the sleeve brush shoes in the same manner as on brushes equipped with rigidly mounted contact shoes as covered in the section.

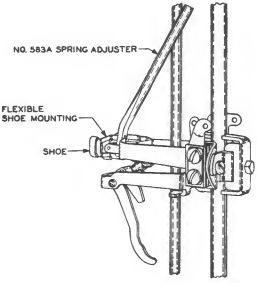

Fig. 32 - Method of Adjusting for Parallelism of Tip and Ring Brush Shoes

3.12 Brush Spring Tension (Rq 2.12)

(1) Readjust the spring tension with the No. 380A adjuster close to the point where the spring leaves the assembly clamping plates and insulators.

(2) When making any adjustment of brush springs, exercise care not to reduce the clearance between the sleeve springs and the rollers and also to prevent any distortion or kinking of the springs, thereby affecting their relation with the corresponding terminals. Make sure that with the brush tripped, the rollers do not touch the sleeve springs.

3.13 Bridging Sleeve Spring Location (Rq 2.13)

(1) If this requirement is not met, and the brush rod is coupled to a No. 1A or No. 2A rack, first ascertain that the brush rod is not worn excessively at the bottom where it rests on the shoulder of the rack. If necessary, recondition the lower end of the brush rod as covered in Section 026-125-804.

(2) To adjust for bridging sleeve spring location, make busy the circuit associated with the brush rod on which the brush to be adjusted is mounted as well as the circuits associated with those brush rods immediately adjacent to it.

(3) Raise the brush rod until the brush under test is approximately two thirds of the way up the bank, and make sure that the weight of the brush rod assembly rests on the clutch pawl.

(4) With the brush in this position, make sure that the contacting surface of either sleeve spring is not tilted from the vertical plane of the contacting portion of the bank terminal enough to interfere with the proper bridging of the brush springs. A tilted brush spring is shown in Fig. 33. If any springs are found tilted away from the terminals in this manner, straighten them with the No. 380A adjuster, and then recheck requirement 2.11.

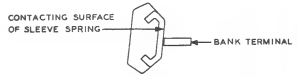

Fig. 33 - Tilted Brush Condition

Lower Sleeve Spring

(5) Use the No. 396A rack locator to locate the brush rod and rack assembly 0.075 inch above the reference terminal in checking the position of the lower sleeve spring. To use the No. 396A rack locater, insert the spring of the tool into the rack notch corresponding to rack index number 45. With the tool in the position shown in Fig. 34, exert a slight downward pressure on the horizontal arm to snap the projection on the tool into the rack notch corresponding to index number 59. Lower the brush rod until the shoulder of the tool rests tightly down against the clutch pawl, taking care not to lower the brush rod assembly to the point where the clutch pawl enters the notch at the lower end of the rack locator. Trip the brush to be tested.

(6) If the adjustment is to be made on an individual brush only, raise a brush rod adjacent to the one being worked on, so that the rack index number 49 shows just above the clutch sighting plate. If the adjustment is to be applied on a number of brush rods, or if it is more convenient, make the circuit busy and raise an end selector to this position instead of raising the one adjacent to the selector containing the brush under test. Trip the brush associated with the same bank as the brush under test.

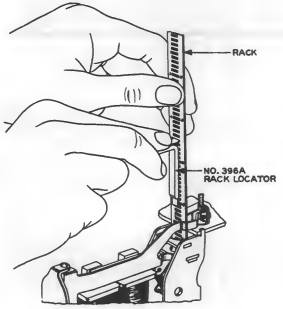

Fig. 34 - Method of Inserting the No. 396A Rack Locater Into the Rack

(7) In accordance with Fig. 35, plug the No. 360A tool on one end of a 1W13B cord onto the terminal of the bottom cap of KS-14250, L1 flashlight and connect the other end of the cord to ground by means of a No. 365 connecting clip. Plug the No. 360A tool on one end of another 1W13B cord onto the other terminal of the bottom cap and connect the other end of this cord to one of the sleeve springs of any brush on the brush rod raised as in (6) by means of a No. 357 spring contact clip.

(8) Operate the flashlight switch. If the flashlight does not light, it indicates that the reference terminal and terminal No. 50 are not busy. However, the circuit from ground, through the flashlight to sleeve terminals Nos. 49 and 50 (see Fig. 35) will cause these terminals to test busy to any hunting selector and thereby avoid interference with service. If the flashlight lights, when the switch is operated, it indicates that either terminal 49 or 50 (or both) are busy. In this case, restore the brush under test. If the light goes out, terminal 50 is busy. In which case proceed to (9). If the flashlight remains lighted, terminal 49 is busy. In this case, open the circuit through the flashlight by removing the No. 357 spring contact clip and test the terminal from time to time until the terminal is idle. Then securely attach the clip. If the reference terminal is permanently made busy, it will be necessary first to attach the No. 357 spring contact clip to the sleeve spring and then remove the strap wire from the terminal at the distributing frame which is associated with the reference terminal.

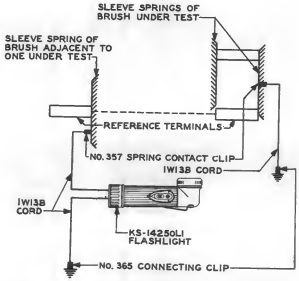
SLEEVE SPRINGS OF BRUSH UNDER TEST
SLEEVE SPRING OF BRUSH ADJACENT TO ONE UNDER TEST
REFERENCE TERMINALS
NO. 357 SPRING CONTACT CLIP
1W13B CORD
1W13B CORD
KS-14250L1 FLASHLIGHT
NO. 365 CONNECTING CLIP

Fig. 35 - Flashlight Circuit Used With No. 396A Rack Locater When Adjusting Lower Bridging Sleeve Spring

(9) With the brush under test tripped, connect one end of a 1W13B cord equipped with No. 360A tools to ground by means of a No. 365 connecting clip. Connect the other end of the this cord to the sleeve spring of one of the other brushes on the same rod as the one under test with a No. 357 spring contact clip. Since the brushes on the rod are in multiple, the sleeve of the brush under test will be grounded. If the sleeve of this brush makes contact with the reference terminal, the flashlight will light.

(10) To determine whether or not the sleeve spring is set within the limits specified, raise or depress the spring by means of the KS-6320 orange stick approximately

0.005 inch, depending on whether the flashlight does or does not light, respectively. If the flashlight goes out when the spring is raised or lights when the spring is depressed this distance, it is an indication that the spring is in adjustment. Fig. 36 shows how the spring may be raised in this manner. If the spring is found to be outside the limits specified as determined by the above test, it will be necessary to adjust it as covered by the following methods.

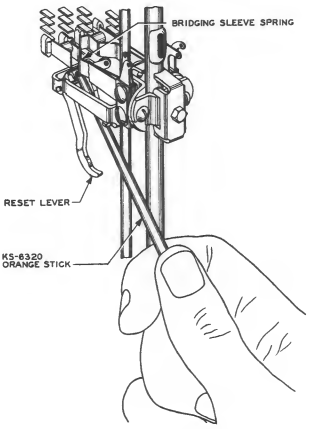

Fig. 36 - Method of Raising Bridging Sleeve Spring to Check Vertical Adjustment

(11) Adjustment of Nos. 11D and 11L, and D-156946, D-157331, and D-159837 Brushes: The Nos. 11D and 11L, and D-156946, D-157331, and D-159837 brushes are manufactured with the correct relation between the sleeve springs and the tip and ring springs to permit making the adjustment for the 0.075-inch contact travel without raising or lowering an individual spring in the spring assembly. Accordingly, if the brush is not in adjustment, shift the brush up or down as required as covered in 3.005 until the sleeve spring just makes or breaks contact with the reference terminal as indicated by the flickering of the flashlight. Because of the greater forward and backward movement permissible in the brush rods at the Nos. 0 and 4 banks, take care when adjusting the brushes on these banks to hold the brush rod as near as possible to its normal vertical position in order not to affect the height of the brush setting.

(12) Adjustment of No. 11A Brush: Adjust this brush the same as outlined in (11) for the No. 11D brush except that it may be necessary to raise or lower the sleeve spring as follows. Determine the lower sleeve spring by eye and loosen the lower screw associated with the spring assembly containing the spring, with the Nos. 206 and 207 screwdrivers. Lower or raise the spring with the No. 380A or the R-2830 adjuster until it just makes or breaks contact with the terminal as shown by the flickering of the flashlight.

(13) If the tip or ring spring associated with this assembly has been thrown out of adjustment by this operation, check it approximately at this time by making sure that the top edge of the contact portion of the tip or ring spring lines up approximately with the bottom edge of the respective tip or ring terminal above the reference terminal. If the spring does not line up with the terminal in this manner, make it do so by raising or lowering the spring as required with the No. 380A adjuster, taking care not to disturb the sleeve spring adjustment. Then tighten the spring assembly clamping screws.

(14) Recheck the sleeve spring adjustment, since the tightening of the screws may change the location of the springs slightly. If necessary, readjust as covered in (11) for the No. 11D brush.

Higher Sleeve Spring

(15) Adjustment of No. 11A Brush: Raise the brush rod until the rack index number 52 shows just above the clutch sighting plate, making sure that the weight of the brush rod assembly rests on the clutch pawl. Check to see that the top edge C of the contacting portion of the higher sleeve spring does not extend above the center line of terminal 53. If the top edge C of the contact portion of the higher sleeve spring extends above the center of the terminal, loosen the lower of the two spring assembly clamping screws of the higher spring with the Nos. 206 and 207 screwdrivers and lower the sleeve spring as required with the No. 380A adjuster or the R-2830 adjuster. Check the tip or ring spring associated with the assembly to see if it has been thrown out of adjustment by this operation. If it has, line it up as covered in (13). Then tighten the spring assembly clamping screws and make sure that requirement 2.12 is met.

(16) If it was necessary to remove a strap wire to make the reference terminal idle, resolder this wire to the proper terminal before disconnecting the flashlight circuit.

(17) Remove the No. 396A tool from the rack, disconnect the flashlight circuit, and lower to the normal position all brush rods which were raised in making this adjustment.

(18) Remove the busy condition imposed on the selector circuits specified in (2).

3.14 Nonbridging Sleeve Spring Location (Rq 2.14)

(1) If this requirement is not met, and the brush rod is coupled to a No. 1A or No. 2A rack, first ascertain that the brush rod is not worn excessively at the bottom where it rests on the shoulder of the rack. If necessary, recondition the lower end of the brush rod as covered in Section 026-125-804.

(2) Raise the brush rod until the rack index number 49 shows just above the clutch sighting plate, making sure that the weight of the brush rod assembly rests on the clutch pawl.

(3) Nos. 11B and 11E Brushes: To locate the sleeve springs of these brushes in accordance with the requirement, raise or lower the brush as covered in 3.005 until the sleeve spring centers on the reference terminal.

(4) Where either the tip or the ring spring fails to meet the requirement, raise or lower the spring at fault by loosening the lower clamping screw of the spring assembly with the Nos. 206 and 207 screwdrivers. Raise or lower the spring as required with the No. 380A adjuster or the R-2830 adjuster and tighten the clamping screw.

(5) Make sure that the requirement is met on terminals 2 and 97. If the requirement is not met, it will be permissible to vary the adjustment on the reference terminal by not more than ±0.010 inch. If the brush still fails to meet the requirement specified for terminals 2 and 97, this is probably due to a displacement of the bank terminals. In this event, refer the matter to the supervisor.

(6) Nos. 11C, 11F, 11G, and 11M, and D-85387, D-156948, D-157332, and D-159838 Brushes (Double Contact Sleeve Springs): To locate the sleeve springs of these brushes in accordance with the requirement, raise or lower the brush as covered in 3.005, until the sleeve springs center on the reference terminal.

(7) If this method will not permit the brush to meet the requirement for both sleeve springs, locate the brush so that one of the sleeve springs centers on the reference terminal. Select the sleeve spring which will afford the best adjustment for the tip and ring springs. Raise or lower the other sleeve spring individually to bring it into the specified position, by loosening the lower clamping screw of the spring assembly with the Nos. 206 and 207 screwdrivers and raising or lowering the sleeve spring as required with the No. 380A adjuster or R-2830 adjuster. Check requirement 2.15 for the tip or ring spring in this same assembly. If necessary, shift the tip or ring spring with the No. 380A adjuster or R-2830 adjuster.

(8) Retighten the assembly clamping screws and again recheck the location of the sleeve spring to see that it is in the required position on the reference terminal.

(9) Check that the requirement is met on terminals 2 and 97, and if necessary readjust in accordance with (5).

3.15 Tip and Ring Spring Location (Rq 2.15)

(1) If this requirement is not met, and the brush rod is coupled to a No. 1A or No. 2A rack, first ascertain that the brush rod is not worn excessively at the bottom where it rests on the shoulder of the rack. If necessary, recondition the lower end of the brush rod as covered in Section 026-125-804.

(2) To check for this requirement, raise the brush rod so that rack index number 49 shows just above the clutch sighting plate with the weight of the brush rod assembly resting on the clutch pawl. Note the setting of the tip and ring springs. If the upper edge of the contact portion of the springs shows at least 0.015 inch (three-quarters thickness of terminal) above the upper edge of the terminal, and the lower edge of the contact portion of the spring shows at least 0.015 inch (three-quarters thickness of terminal) below the lower edge of the terminal, the adjustment may be assumed to be satisfactory for any terminal in the bank.

(3) Before adjusting for this requirement, first determine that the sleeve springs have their correct setting. If this setting is incorrect, readjust the sleeve springs as covered in 3.13 and 3.14. If, after this adjustment, it is found that the tip and ring springs fail to meet the limits specified, adjust the spring at fault as follows.

(4) Loosen the lower spring assembly clamping screw with the Nos. 206 and 207 screwdrivers and raise or lower the spring with the No. 380A adjuster or the R-2830 adjuster until there is at least 0.015-inch contact metal of the spring showing above or below the reference terminal. Tighten the assembly screw. After making this adjustment, check to see that requirement 2.15(a) is met at other points on the bank. If the brush fails to meet this requirement, it is probably due to a displacement of the bank terminals. In this event, refer matter to the supervisor.

3.16 Point of Contact Between Trip Armature Extension and Rotating Lever (Rq 2.16)
3.17 Clearance Between Rotating Lever and Top Clutch Locating Plate (Rq 2.17)
3.18 Vertical Location of Trip Armature Extension With Respect to Rotating Lever (Rq 2.18)
3.19 Parallelism of Contact Between Trip Armature Extension and Rotating Lever (Rq 2.19)
3.20 Location of Sharp Edge of Trip Armature Extension (Rq 2.20)
3.21 Clearance Between Trip Armature Extension and Rack (Rq 2.21)
3.22 Clearance Between Trip Armature Extension and Adjacent Brush (Rq 2.22)

(1) In adjusting for requirements 2.16, 2.18, 2.19, 2.20, 2.21, and 2.22, bend the trip armature extension with the No. 325B adjuster while holding it with the No. 326B adjuster as outlined in 3.23, taking care that requirements 2.23 and 2.24 can still be met.

(2) In adjusting for requirement 2.18, it may also be necessary to raise or lower the rotating lever. To do this, slightly loosen the clamping screws with the 3-inch cabinet screwdriver and shift the rotating lever up or down, making sure that requirement 2.17 can be met. Exercise care when shifting the rotating lever not to move it in a rotary direction about the trip rod, since this would affect the requirements governing the adjustment of the trip fingers and the trip armature extension of the clutch. In resetting the rotating lever, make sure that the rotating lever retractile spring is as nearly horizontal as possible.

(3) Make sure that the retractile spring has sufficient tension to restore the rotating lever firmly back to normal by manually operating and releasing the trip magnet armature. If necessary, replace the retractile spring with a new one as covered in Section 026-125-804.

3.23 Clearance Between End of Trip Finger and Sleeve Springs (Rq 2.23)
3.24 Horizontal Clearance Between Trip Finger and Trip Lever (Rq 2.24)

(1) With the trip finger in the normal position, slowly raise the brush rod and make sure that the sleeve spring and the trip lever of the brush clear the trip finger as specified.

(2) Restore the brush rod to normal and electrically operate the trip magnet. Slowly raise the brush rod and make sure that the other sleeve spring and the trip lever of the brush clear the trip finger as specified. Release the trip magnet.

(3) If the trouble is not due to a general misalignment of all the trip fingers, check the location of the brush to see that it meets requirement 2.09.

(4) To change the position and the angular travel of all the trip fingers on a trip rod to meet these requirements, one or a combination of the methods given in (5) to (9), inclusive, may be used.

(5) Adjust the trip armature extension of the clutch as shown in Figs. 37 and 38 so as to engage the rotating lever nearer to its center and thus increase the swing of the lever.

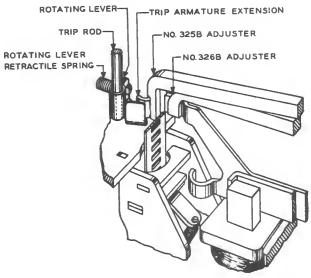

Fig. 37 - Method of Adjusting Trip Armature Extension

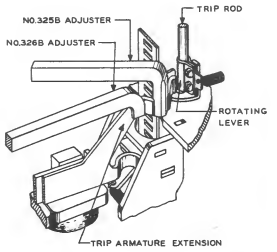

Fig. 38 - Method of Adjusting Trip Armature Extension

(6) Adjust the trip armature extension of the clutch directly over the semicircular stop to change the position of the trip finger swing without changing the amount of swing as shown in Fig. 39. Use the No. 326B adjuster for holding the trip magnet armature while adjusting it with a No. 325B adjuster.

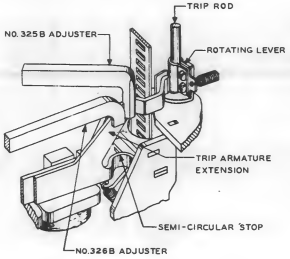

Fig. 39 - Method of Adjusting Trip Armature Extension

(7) Adjust the semicircular portion of the trip armature extension as necessary with the long-nose pliers as shown in Fig. 40, taking care not to adjust it to such an extent as to cause interference between the trip armature extension and the rack or the reset lever of the adjacent brush.

(8) After making any adjustment of the trip armature extension, check that all requirements governing the position of the trip armature extension are met.

(9) When the rotating lever is not located on the trip rod in a position to allow the proper swing of the trip finger, loosen the rotating lever clamping screws slightly with the 3-inch cabinet screwdriver and relocate the rotating lever on the trip rod. Exercise care when shifting the rotating lever not to raise or lower it, since this would affect the requirements governing the position of the rotating lever with respect to the top clutch locating plate and with respect to the trip armature extension. Tighten the rotating lever clamping screws and make sure that the retractile spring has sufficient tension to restore the rotating lever firmly back to normal by manually operating and releasing the trip magnet armature. If necessary, replace the retractile spring with a new one as covered in Section 026-125-804.

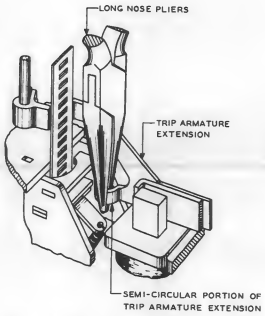

Fig. 40 - Method of Adjusting the Semicircular Portion of the Trip Armature Extension

(10) If the normal position of one trip finger is out with respect to the others, adjust the trip finger backstop. The backstop may be adjusted to the right by means of the blade of the 3-inch cabinet screwdriver placed between it and the trip rod as shown in Fig. 41. Adjust it forward with a pair of long-nose pliers as shown in Fig. 42. Exercise care in making this adjustment to prevent injury to the trip finger.

(11) Restore the brush rod assembly to normal.

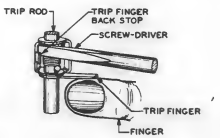

Fig. 41 - Method of Adjusting Trip Finger Backstops

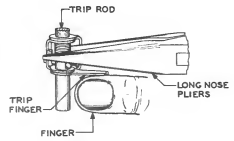

Fig. 42 - Method of Adjusting Trip Finger Backstops

3.25 Trip Finger Return to Normal (Rq 2.25)

(1) To check for the trip finger return to normal, pull the trip finger back about 30 degrees and allow it to return very slowly to normal.

(2) Adjust a trip finger which binds by inserting the edge of the KS-6854 screwdriver between the horizontal flanges of the trip finger frame and yoke, either top or bottom, and then twisting the screwdriver slightly as shown in Fig. 43. Where it is found necessary to free the trip fingers in this manner, take care not to adjust the trip finger frame or yoke to such an extent as to cause excessive end play, because of its effect on trip finger height adjustments.

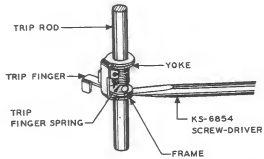

Fig. 43 - Method of Adjusting Binding Trip Fingers

(3) If the top and bottom flanges are spread too far, causing a bind, pinch them together with the long-nose pliers as shown in Fig. 44.

(4) In some cases the trip finger may be sluggish in returning to normal because of an accumulation of foreign matter between adjacent turns of the trip finger spring. This condition can generally be relieved by placing the tip of the blade of the 3-inch cabinet screwdriver against the top of the spring and pushing the blade downward over the turns of the spring so as to compress the spring and cause each turn to snap against its adjacent turn.

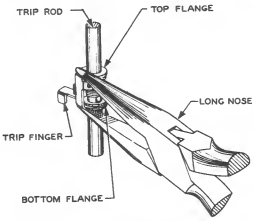

Fig. 44 - Method of Adjusting Binding Trip Fingers

(5) If the trip finger is sluggish in returning to normal because of a gummy substance adhering to the trip finger parts, flush the parts thoroughly with KS-7860 petroleum spirits applied with the KS-14164 brush. Take care to prevent the petroleum spirits from coming in contact with adjacent parts.

(6) Where the trip finger has a round hole for engaging the trip finger spring and is still sluggish in returning to normal, the sluggishness may be caused by a bind between the trip rod and the turns of the spring. This condition can be corrected by means of the D-159676 trip finger spring adjuster as covered in (7) to (9), inclusive.

(7) Make busy the circuit associated with the trip rod on which the trip finger spring to be adjusted is mounted as well as the circuits associated with those rods immediately adjacent to it. Raise the brush rods of the three busy circuits so the brushes will not interfere. It may also be necessary to uncouple the rack from the brush rod when the No. 0 bank trip finger spring is to be adjusted.

(8) With one hand, manually rotate the trip finger about 1/4 revolution in a counterclockwise direction as viewed from above. With the other hand, carefully insert the tip of the needle of the D-159676 trip finger spring adjuster into the hole in the trip finger through which the trip finger spring is hooked, as shown in Fig. 45. In doing this, take care that the part of the spring which passes through the hole in the trip finger enters the fluted portion of the needle. Push the needle straight into the hole as far as it will go, at the same time exerting pressure against the trip rod with the finger behind the rod so as to balance the pressure of forcing the needle into the hole. Position the finger which is exerting pressure against the trip rod so that injury to the finger is avoided in case the needle

accidently slips out or breaks. In pushing the needle into the hole, take care not to push sideways with the tool and thus possibly break the needle. When removing the tool, make sure that the trip finger spring is still reliably hooked to the trip finger. In general, one application of the tool will properly form the spring.

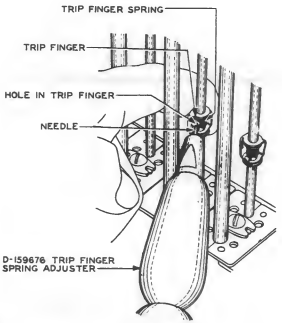

Fig. 45 - Method of Adjusting Trip Finger Spring

Note: Trip fingers manufactured before 1928 may have trip finger holes slightly smaller than the needle, in which case dress down the needle slightly with No. 00 emery cloth and clean off any abrasive adhering to the needle.

(9) When the requirement is met, restore the brush rods to normal and remove the busy conditions.

3.26 Freedom of Movement of Trip Rod (Rq 2.26)

(1) If it is noted that the trip rod is sluggish when operated and released, first make sure that requirements 2.16, 2.17, 2.20, and 2.30 have been met and make sure that the trip rod is free at each bearing. Also make sure that the trip rod does not bind at its lower end because of dirt in the mounting hole, and if it does, loosen the stop collar with the KS-6854 screwdriver, lift out the trip rod, and flush out the trip rod mounting hole in the top clutch locating plate with KS-7860 petroleum spirits applied with the KS-14164 brush. After the hole has been cleaned out, reassemble the trip rod and adjust the trip rod stop collar as covered in 3.30.

(2) If the cause of the sluggish return of the trip rod is a weak retractile spring, replace the spring with a new one as covered in Section 026-125-804.

3.27 Vertical Clearance Between Bottom of Horizontal Flange of Trip Finger and Trip Lever (Rq 2.27)

(1) To obtain this clearance, adjust the trip finger very slightly up or down as required with a No. 50B adjuster as shown in Fig. 46, taking care not to throw the horizontal flange out of square with the trip rod.

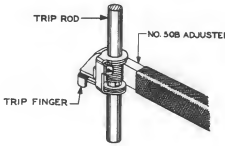

Fig. 46 - Method of Adjusting Clearance Between Bottom of Trip Finger Flange and Trip Lever

(2) At the time this requirement is being checked, make a visual check for excessive trip finger end play, that is, excessive gap between the top or bottom horizontal flange of the trip finger frame and the yoke. If the trip finger is adjusted near the minimum or maximum height adjustment, see that the requirement is met with the end play of the trip finger taken up in either direction.

3.28 Downstop Collar Location (Rq 2.28)

(1) The stop collars now in use are of two types; the earlier type used two upstop and two downstop collars for each brush rod, and the later type required only one upstop and one downstop collar. The procedure used in adjusting stop collars of either type is essentially the same.

(2) First make sure that the commutator brush springs are in correct adjustment as specified in Section 026-120-701.

(3) Y Commutator Brush Spring Clearance: If possible, adjust for this clearance during periods of light load in order that the weight of as many selectors as possible will be resting on the cross members. Loosen the downstop collar clamping screws (if one of the later type) with the No. 555A wrench. If the rod is equipped with earlier-type downstop collars, loosen the clamping screws

with the KS-2631 screwdriver or the wrench. Raise the brush rod approximately 1/8 inch and push the downstop collar or collars down on the bearings. Then tighten the clamping screws just sufficiently to support the weight of the brush rod. Grasp the brush rod just below the commutator brush frame and tap the downstop collar or collars up by carefully raising and lowering the brush rod until the bottom edge of the Y commutator brush spring clears the top edge of the reference hole in the Y commutator segment by the specified amount. With the downstop collar or collars in this position, tighten the clamping screws sufficiently to prevent the collar or collars from slipping on the brush rod. Scribe a line on the brush rod at the top of the downstop collar with the No. 240 scriber, and in subsequent adjustments, make sure that the top of the downstop collar is not raised above the scribed line.

(4) Brush Reset: If the brush will not reset under the conditions specified in the requirement, lower the brush as covered in 3.005, taking care that there is the specified clearance between the brush frame and the top of the downstop collar. If the brush resets properly under the conditions specified, and there is not the specified clearance between the downstop collar and the brush frame, lower the downstop collar or collars. When checking to see that the reset lever restores with a snap with the proper gauge inserted between the downstop collar and the bearing plate, make sure that the reset lever does not ride off the side of the bearing or reset plates when the brush resets.

(5) If the reset lever is sluggish or fails to restore fully to its normal position, this may be caused by friction between the rollers and the connecting plate on the trip lever assembly. To remedy this condition, lubricate the surfaces of the rollers which come in contact with the connecting plate with one dip of KS-8496 lubricating compound No. 3. To do this, raise the brush rod and trip the brush. Apply the lubricant as shown in Fig. 47. After the lubricant has been applied, restore and trip the brush a few times manually to insure that the lubricant will reach the entire surfaces of the rollers where they come in contact with the connecting plate.

(6) If the reset lever snags against its associated reset or bearing plate when the brush restores, lubricate the reset lever and the reset or bearing plate as covered in 3.01.

(7) Clearance Between Each Brush Frame and Cross Member: If the lack of clearance is general for all brushes on the rod, lower the downstop collar or collars. If the lack of clearance is not general, raise the brush as covered in 3.005 and lower the springs as covered in 3.13, 3.14, and 3.15, making sure

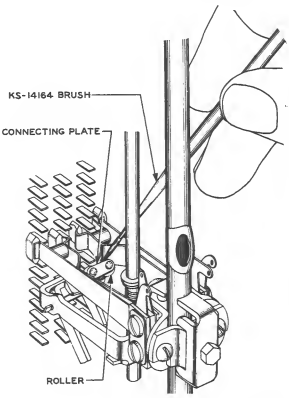

Fig. 47 - Method of Lubricating the Connecting Plate and Rollers on the Trip Lever Assembly

that requirements 2.13, 2.14, 2.15, and 2.23 are met. In any case, if an adjustment is necessary, recheck for brush reset and readjust for it, if necessary.

(8) Location of One Earlier-type Downstop Collar With Respect to Bearing: When the final location of the earlier-type downstop collars has been obtained as outlined above, lower the brush rod until one of the downstop collars rests against the bearing plate. Loosen the clamping screw of the other downstop collar, slide it down snugly against its associated bearing, and fasten it in place.

(9) See that the clamping screws of all the downstop collars are securely tightened. If any downstop collars have been raised, make sure that, when the brush rod is lowered to the normal or lowest position, the top of the rack is above the underside of the rack guide.

3.29 Clearance Between Brush Rod Upstop Collar and Bottom of Bearing Plate (Rq 2.29)

(1) To make the adjustment, raise the brush rod until the rack index number 101 shows just above the clutch sighting plate, making sure that the weight of the brush rod assembly rests on the clutch pawl.

(2) With the brush rod in this position, if a later-type upstop collar is used, check to see that the top surface of the collar is within the required limits.

(3) To adjust the later-type upstop collars, shift them on the rod, as required, using the No. 555A wrench to loosen and tighten the clamping screw.

(4) If the earlier-type upstop collars are used, see that one of the collars is the same distance away from the bearing plate as set forth above for the later-type collar.

(5) To adjust the earlier-type upstop collars, shift one of them on the rod, as required, using the KS-2631 screwdriver or the No. 555A wrench to loosen and tighten the stop collar clamping screw. Raise the brush rod until the adjusted collar touches against the underside of the bearing plate. Then, securely fasten the other earlier-type upstop collar so that its top surface fits snugly against the underside of the associated bearing plate. Check the setting by lowering the brush rod and raising it under power as far as it will go. Make sure that with one upstop collar resting against the bearing plate, the gap between the other collar and its associated bearing plate is not more than approximately 0.005 inch. Remove the updrive power and make sure that the rack index number 101 shows just above the clutch sighting plate with the weight of the brush rod assembly on the clutch pawl. With the rod in this position, raise the rod by hand and make sure that the specified travel exists in the rod before the stop collars engage with the bearing plate.

3.30 Clearance Between Trip Rod Upstop Collar and Bottom of Bearing Plate (Rq 2.30)

(1) To adjust for this clearance, loosen the trip rod stop collar clamping screw with the KS-2631 screwdriver or the No. 555A wrench, depending on whether the screw has a slotted or a hexagonal head, and insert the No. 85F gauge between the bearing plate and the top edge of the collar. Raise the collar until the gauge is snug against the underside of the plate, then securely tighten the collar clamping screw.

(2) The adjustment should insure the collar sufficient clearance from the bearing plate, so that the trip rod will be free to turn in its bearings and will not be great enough to disturb the trip finger adjustment when the trip rod is lifted while the brush is being tripped. Make sure that, with the trip rod in its normal position, the stop collar does not touch the bearing clamp, and when the trip rod is allowed to return to normal slowly after being operated and raised, the stop collar does not catch in the slot in the bearing plate.

3.31 Clearance Between Brush Frame and Bank Terminals (Rq 2.31)

(1) Determine if the condition is caused by a bowed rack and if so, straighten it by following the procedures outlined in the section covering the particular type of clutch involved.

(2) If the necessary clearance is not now visible, inspect the brush rod for kinks, bows, or a bent condition at the rack tongue slot. Remove any bowing or kinking of the rod as covered in 3.05. If the required clearance is still unobtainable, move the bearing closest to the faulty part of the rod so as to obtain the required clearance. Take care, however, not to move the bearing enough to prevent the brush from meeting requirements 2.05 and 2.08.

(3) If the required clearance cannot be met on the No. 4 banks on earlier frames which are not equipped with a bearing plate between the No. 4 bank and the commutators, the trouble is due to a bent or bowed brush rod. Correct this condition as outlined in 3.05.

3.32 Smooth Brush Travel (Rq 2.32)

(1) See that the brushes are centered so that they reliably clear all the terminals of the banks, when in a reset condition, as the selector travels up or down.

(2) Correct chattering or snagging by adjusting the springs causing the trouble so that their contact surfaces are within the parallelism requirement. Use the No. 380A adjuster for this purpose. At this time, check the correct location of the multiple bank terminals in accordance with Section 026-110-701.

(3) If the brush still chatters or snags, replace it with a new one as covered in Section 026-125-804.

3.33 Location of No. 8A Indicator on Final Frames (Rq 2.33)

(1) To adjust an indicator which is not within the required limits, loosen one of the screws on the pointer with the KS-2631 screwdriver and raise or lower the pointer as required.

(2) After the desired adjustment has been obtained, securely tighten the pointer mounting screws.